

late 08/12/2015

page 1 of 6

# **SERIES:** PQB3-D | **DESCRIPTION:** DC-DC CONVERTER

#### **FEATURES**

- 3 W isolated output
- smaller package
- single/dual regulated output
- 1,500 Vdc isolation
- short circuit protection
- temperature range (-40~105°C)
- UL 60950-1 approval
- high efficiency at light load
- efficiency up to 86%





MODEL	input output output voltage voltage current			output power	ripple and noise <sup>2</sup>	efficiency		
	<b>typ</b> (Vdc)	range (Vdc)	(Vdc)	min (mA)	max (mA)	max (W)	max (mVp-p)	<b>typ</b> (%)
PQB3-D5-S5-D	5	4.5~9	5	30	600	3	80	74
PQB3-D5-S12-D	5	4.5~9	12	12	250	3	80	77
PQB3-D5-S15-D	5	4.5~9	15	10	200	3	80	77
PQB3-D5-D5-D	5	4.5~9	±5	±15	±300	3	80	76
PQB3-D5-D12-D	5	4.5~9	±12	±6	±125	3	80	78
PQB3-D5-D15-D	5	4.5~9	±15	±5	±100	3	80	78
PQB3-D12-S3-D	12	9~18	3.3	46	909	3	80	74
PQB3-D12-S5-D	12	9~18	5	30	600	3	80	81
PQB3-D12-S12-D	12	9~18	12	12	250	3	80	83
PQB3-D12-S15-D	12	9~18	15	10	200	3	80	82
PQB3-D12-S24-D	12	9~18	24	6	125	3	80	83
PQB3-D12-D5-D	12	9~18	±5	±15	±300	3	80	81
PQB3-D12-D9-D	12	9~18	±9	±8	±166	3	80	84
PQB3-D12-D12-D	12	9~18	±12	±6	±125	3	80	84
PQB3-D12-D15-D	12	9~18	±15	±5	±100	3	80	85
PQB3-D24-S3-D	24	18~36	3.3	46	909	3	80	78
PQB3-D24-S5-D1	24	18~36	5	30	600	3	80	81
PQB3-D24-S12-D	24	18~36	12	12	250	3	80	86
PQB3-D24-S15-D	24	18~36	15	10	200	3	80	86
PQB3-D24-S24-D	24	18~36	24	6	125	3	80	85
PQB3-D24-D5-D	24	18~36	±5	±15	±300	3	80	82
PQB3-D24-D12-D	24	18~36	±12	±6	±125	3	80	84
PQB3-D24-D15-D	24	18~36	±15	±5	±100	3	80	84
PQB3-D48-S3-D	48	36~75	3.3	46	909	3	80	76
PQB3-D48-S5-D	48	36~75	5	30	600	3	80	82
PQB3-D48-S12-D	48	36~75	12	12	250	3	80	86
PQB3-D48-S15-D	48	36~75	15	10	200	3	80	86

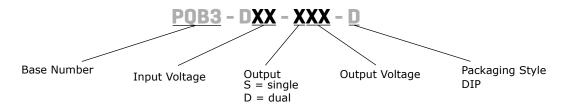
Notes: 1. UL approved

<sup>2.</sup> Ripple and noise are measured at 20 MHz BW by "parallel cable" method with 1 µF ceramic and 10 µF electrolytic capacitors on the output.

MODEL		nput oltage	output voltage		tput rrent	output power	ripple and noise <sup>2</sup>	efficiency
(CONTINUED)	<b>typ</b> (Vdc)	range (Vdc)	(Vdc)	<b>min</b> (mA)	max (mA)	max (W)	<b>typ</b> (mVp-p)	<b>typ</b> (%)
PQB3-D48-D5-D	48	36~75	±5	±15	±300	3	80	82
PQB3-D48-D12-D	48	36~75	±12	±6	±125	3	80	84
PQB3-D48-D15-D	48	36~75	±15	±5	±100	3	80	85

Notes:

# **PART NUMBER KEY**



# **INPUT**

parameter conditions/description		min	typ	max	units
	5 Vdc input models	4.5	5	9	Vdc
anaustina innut valtasa	12 Vdc input models	9	12	18	Vdc
operating input voltage	24 Vdc input models	18	24	36	Vdc
	48 Vdc input models	36	48	75	Vdc
	5 Vdc input models			4.5	Vdc
start un voltage	12 Vdc input models			9	Vdc
start-up voltage	24 Vdc input models			18	Vdc
	48 Vdc input models			36	Vdc
	for maximum of 1 second				
	5 Vdc input models	-0.7		12	Vdc
surge voltage	12 Vdc input models	-0.7		25	Vdc
5	24 Vdc input models	-0.7		50	Vdc
	48 Vdc input models	-0.7		100	Vdc
filter	pi filter				

# **OUTPUT**

parameter	conditions/description	min	typ	max	units
line regulation	full load, input voltage from low to high		±0.2	±0.5	%
load regulation	5% to 100% load		±0.2	±0.5	%
voltage accuracy			±1	±3	%
no-load voltage accuracy			±1.5	±5	%
voltage balance <sup>3</sup>	dual output, balanced loads		±0.5	±1	%
switching frequency	100% load, nominal input voltage, PFM mode		200		kHz
transient recovery time	25% load step change		0.5	2	ms
transient response deviation	25% load step change		±2	±5	%
temperature coeffecient	100% load		±0.02	±0.03	%/°C

Notes: 3. For dual output models, unbalanced loads should not exceed  $\pm 5\%$ . If  $\pm 5\%$  is exceeded, it may not meet all specifications.

# **PROTECTIONS**

parameter	conditions/description	min	typ	max	units
short circuit protection <sup>4</sup>				1	S

Notes: 4. The supply voltage must be discontinued at the end of the short circuit duration  $\frac{1}{2}$ 

<sup>1.</sup> UL approved
2. Ripple and noise are measured at 20 MHz BW by "parallel cable" method with 1 µF ceramic and 10 µF electrolytic capacitors on the output.

# **SAFETY AND COMPLIANCE**

parameter	conditions/description	min	typ	max	units	
isolation voltage	input to output for 1 minute at 1 mA max.	1,500			Vdc	
isolation resistance	input to output at 500 Vdc	1,000			MΩ	
safety approvals <sup>1</sup>	UL 60950-1					
conducted emissions	CISPR22/EN55022, class A; class B (external of	circuit required, see	Figure 1-b)			
radiated emissions	CISPR22/EN55022, class A; class B (external of	circuit required, see	Figure 1-b)			
ESD	IEC/EN61000-4-2, class B, contact ± 4kV/air =	IEC/EN61000-4-2, class B, contact ± 4kV/air ± 8kV				
radiated immunity	IEC/EN61000-4-3, class A, 10V/m					
EFT/burst	IEC/EN61000-4-4, class B, ± 2kV (external cir	cuit required, see F	igure 1-a)			
surge	IEC/EN61000-4-5, class B, ± 2kV (external cir	cuit required, see F	igure 1-a)			
conducted immunity	IEC/EN61000-4-6, class A, 3 Vr.m.s					
voltage dips & interruptions	IEC/EN61000-4-29, class B, 0%-70%					
MTBF	as per MIL-HDBK-217F @ 25°C	1,000,000			hours	
RoHS	2011/65/EU					

Notes: 1. See specific model noted on page 1

# **ENVIRONMENTAL**

parameter	conditions/description	min	typ	max	units
operating temperature	see derating curve	-40		105	°C
storage temperature		-55		125	°C
storage humidity	non-condensing			95	%
temperature rise	at full load, Ta=25°C		25		°C

# **SOLDERABILITY**

parameter	conditions/description	conditions/description     min     typ       1.5 mm from case for 10 seconds		max	units
hand soldering	1.5 mm from case for 10 seconds			300	°C
wave soldering	see wave soldering profile	see wave soldering profile		260	°C

# **MECHANICAL**

parameter	conditions/description	min	typ	max	units
dimensions	31.60 x 20.30 x 10.20 (1.244 x 0.799 x 0.402 inch)	31.60 x 20.30 x 10.20 (1.244 x 0.799 x 0.402 inch)		mm	
case material	plastic (UL94-V0)				
weight			14		g

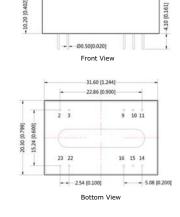
# **MECHANICAL DRAWING**

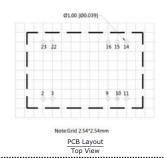
units: mm[inch]

tolerance:  $\pm 0.50[\pm 0.020]$ 

pin section tolerance:  $\pm 0.10[\pm 0.004]$ 

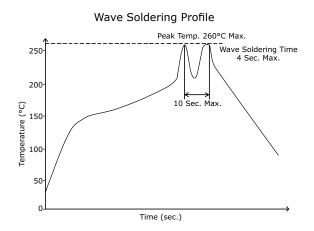
PIN CONNECTIONS				
PIN	Single Output	Dual Output		
2, 3	GND	GND		
9	NC	0V		
10,15	NC	NC		
11	NC	-Vo		
14	+Vo	+Vo		
16	0V	0V		
22, 23	Vin	Vin		

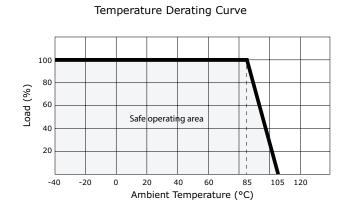




NC: No Connection

# **DERATING CURVES**





# **EMC RECOMMENDED CIRCUIT**

Figure 1

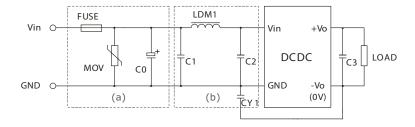


Table 1

	Recommended external circuit components							
Vin (Vdc)	5	5 12 24		48				
FUSE	choose according to practical input current							
MOV		S14K25	S14K35	S14K60				
C0	1000µF/16V	1000μF/25V	330µF/50V	330µF/100V				
C1	4.7μF/50V	4.7μF/50V	4.7μF/50V	4.7μF/100V				
LDM1	12µH	12µH	12µH	12µH				
C2	4.7μF/50V	4.7μF/50V	4.7μF/50V	4.7μF/100V				
C3	10μF	10µF	10μF	10μF				
CY1	1nF/2kV	1nF/2kV	1nF/2kV	1nF/2kV				

### **APPLICATION NOTES**

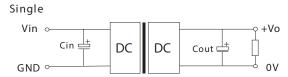
#### **Output load requirement**

To ensure this module can operate efficiently and reliably, the minimum output load may not be less than 5% of the full load during operation. If the actual output power is low, connect a resistor at the output end in parallel to increase the load.

#### Recommended circuit

This series has been tested according to the following recommended testing circuit before leaving the factory. This series should be tested under load (see Figure 2 & Table 2). If you want to further decrease the input/output ripple, you can increase the capacitance accordingly or choose capacitors with low ESR. However, the capacitance of the output filter capacitor must be appropriate. If the capacitance is too high, a startup problem might arise. For every channel of the output, to ensure safe and reliable operation, the maximum capacitance must be less than the maximum capacitive load (see Table 3).

Figure 2



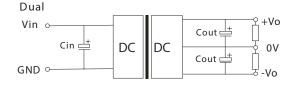


Table 2

	Vin (Vdc)	Cin (µF)	Cout (µF)
	5	100	10
	12	100	10
	24	10~47	10
I	48	10~47	10

Table 3

Single Vout (Vdc)	Max. Capacitive Load (µF)	Dual Vout (Vdc)	Max. Capacitive Load¹ (µF)
3.3	4700		
5	4700	5	2200
12	2700	9	2000
15	2200	12	1800
24	1800	15	1000

Note:

1. For each output.

#### **Input Current**

When it is used in an unregulated condition, make sure that the input fluctuations and ripple voltage do not exceed the module standard. Refer to Figure 3 and Table 4 for the startup current of this dc-dc module.

Figure 3

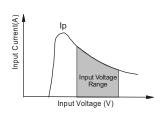


Table 4

Vin (Vdc)	Ip (mA)
5	1400
12	620
24	310
48	150

Note:

<sup>1.</sup> Minimum load shouldn't be less than 5%, otherwise ripple may increase dramatically. Operation under minimum load will not damage the converter, however, they may not meet all specifications listed.

<sup>2.</sup> Maximum capacitive load is tested at input voltage range and full load.

<sup>3.</sup> All specifications are measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.

### **REVISION HISTORY**

rev.	description	date
1.0	initial release	03/19/2013
1.01	added models, added UL approval to model, updated datasheet	08/12/2015

The revision history provided is for informational purposes only and is believed to be accurate.



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